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| FORM PTO-1390 (REV 5-93) | | U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE | | ATTORNEY DOCKET NO. P8306-9004 | |
| TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371 | | | | DATE: April 7, 1999 | |
| | | | | U.S. APPLN. NO. (IF KNOWN, SEE 37 CFR 1.51) 09/269754 | |
| INTERNATIONAL APPLICATION NO. PCT/FI97/00605 | | INTERNATIONAL FILING DATE 7 October 1997 | | PRIORITY DATE CLAIMED 8 October 1996 | |
| TITLE OF INVENTION: AN ELECTRIC MACHINE CONSTRUCTION AND A METHOD FOR AN ELECTRIC MACHINE | | | | | |
| APPLICANT(S) FOR DO/EO/US: Juha PYRHÖNEN | | | | | |
| <p>1. <input checked="" type="checkbox"/> This is a FIRST submission of items concerning a filing under 35 U.S.C. 371. (THE BASIC FILING FEE IS ATTACHED)</p> <p>2. <input type="checkbox"/> This is a SECOND or SUBSEQUENT submission of items concerning a filing under 35 U.S.C. 371.</p> <p>3. <input checked="" type="checkbox"/> This express request to begin national examination procedures (35 U.S.C. 371(f) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT articles 22 and 39(1).</p> <p>4. <input checked="" type="checkbox"/> A proper demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.</p> <p>5. <input checked="" type="checkbox"/> A copy of the International Application as filed (35 U.S.C. 371(c)(2))</p> <p>a. <input type="checkbox"/> is transmitted herewith (required only if not transmitted by the International Bureau).</p> <p>b. <input checked="" type="checkbox"/> has been transmitted by the International Bureau.</p> <p>c. <input type="checkbox"/> is not required, as the application was filed in the United States Receiving Office (RO/US)</p> <p>6. <input checked="" type="checkbox"/> A translation of the International Application into English (35 U.S.C. 371(c)(2)).</p> <p>7. <input type="checkbox"/> Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))</p> <p>a. <input type="checkbox"/> are transmitted herewith (required only if not transmitted by the International Bureau).</p> <p>b. <input type="checkbox"/> have been transmitted by the International Bureau.</p> <p>c. <input type="checkbox"/> have not been made; however, the time limit for making such amendments has NOT expired.</p> <p>d. <input type="checkbox"/> have not been made and will not be made.</p> <p>8. <input type="checkbox"/> A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).</p> <p>9. <input checked="" type="checkbox"/> An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).</p> <p>10. <input checked="" type="checkbox"/> A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).</p> <p>Items 11. to 16. below concern other document(s) or information included:</p> <p>11. <input checked="" type="checkbox"/> An Information Disclosure Statement under 37 CFR 1.97 and 1.98.</p> <p>12. <input checked="" type="checkbox"/> An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.</p> <p>13. <input checked="" type="checkbox"/> A FIRST preliminary amendment. <input type="checkbox"/> A SECOND or SUBSEQUENT preliminary amendment.</p> <p>14. <input type="checkbox"/> A substitute specification.</p> <p>15. <input type="checkbox"/> A change of power of attorney and/or address letter.</p> <p>16. <input checked="" type="checkbox"/> Other items or information: Small Entity Declaration; Form PCT/ISA/210; 3 refs; Form PCT/IPEA/409; Form PCT/IPEA/401; Form PCT/RO/101; CHECK NO. 19225 Drawing(s) - 7 sheets</p> | | | | | |

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|---|--------------|--|------------|--|--|--------------|--------------|
| U.S. APPLN. NO. (IF KNOWN, SEE 37 C.F.R. 1.50) | | INTERNATIONAL APPLICATION NO. PCT/FI97/00605 | | ATTORNEY DOCKET NO. P8306-9004 DATE: April 7, 1999 | | | |
| 17. <input checked="" type="checkbox"/> The following fees are submitted: Basic National Fee (37 CFR 1.492(a)(1)-(5)): Search Report has been prepared by the EPO or JPO.....\$840.00 International preliminary examination fee paid to USPTO (37 CFR 1.482)....\$670.00 No international preliminary examination fee paid to USPTO (37 CFR 1.482) but international search fee paid to USPTO (37 CFR 1.445(a)(2)).....\$760.00 Neither international preliminary examination fee (37 CFR 1.482) or international search fee (37 CFR 1.445(a)(2)) paid to USPTO.....\$970.00 International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(2)-(4)\$ 96.00 | | | | <table style="width: 100%; border: none;"> <tr> <td style="width: 60%; border-bottom: 1px solid black; text-align: center;">CALCULATIONS</td> <td style="width: 40%; border-bottom: 1px solid black; text-align: center;">PTO USE ONLY</td> </tr> </table> | | CALCULATIONS | PTO USE ONLY |
| CALCULATIONS | PTO USE ONLY | | | | | | |
| ENTER APPROPRIATE BASIC FEE AMOUNT = | | | | \$970.00 | | | |
| Surcharge of \$130.00 for furnishing the oath or declaration later than _ 20 _ 30 months from the earliest claimed priority date (37 CFR 1.492(e)). | | | | | | | |
| Claims | Number Filed | Number Extra | Rate | | | | |
| Total Claims | 12 - 20 = | 0 | X \$ 18.00 | | | | |
| Independent Claims | 2 - 3 = | 0 | X \$ 78.00 | | | | |
| Multiple dependent claim(s) (if applicable) | | | + \$260.00 | | | | |
| TOTAL OF ABOVE CALCULATIONS = | | | | \$970.00 | | | |
| Reduction by 1/2 for filing by small entity, if applicable. Verified Small Entity statement must also be filed. (Note 37 CFR 1.9, 1.27, 1.28). | | | | \$-485.00 | | | |
| SUBTOTAL = | | | | \$485.00 | | | |
| Processing fee of \$130.00 for furnishing the English translation later the _ 20 _ 30 months from the earliest claimed priority date (37 CFR 1.492(f)). | | | | | | | |
| TOTAL NATIONAL FEE = | | | | \$485.00 | | | |
| Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). \$40.00 per property | | | | \$40.00 | | | |
| TOTAL FEES ENCLOSED = | | | | \$525.00 | | | |
| | | | | Amount to be refunded \$ | | | |
| | | | | Charged \$ | | | |
| a. <input checked="" type="checkbox"/> A check in the amount of <u>\$525.00</u> to cover the above fees is enclosed. b. <input type="checkbox"/> Please charge my Deposit Account No. <u>14-1060</u> in the amount of \$_____ to cover the above fees. A duplicate copy of this sheet is enclosed. c. <input checked="" type="checkbox"/> The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. <u>14-1060</u> . | | | | | | | |
| NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status. | | | | | | | |
| SEND ALL CORRESPONDENCE TO: NIKAIDO, MARMELSTEIN, MURRAY AND ORAM Metropolitan Square 655 15th Street, N.W. Suite 330 - G Street Lobby Washington, D.C. 20005-5701 Telephone No. (202) 638-5000 | | | | | | | |
| Douglas H. Goldhush Reg. No. 33,125 | | | | | | | |

electric machine [(10)] is attached [(32)] directly to the end portion [(6)] of the electric machine construction, whereby [the attachment means (5)] a support integrated in the end portion [(6)] of the machine construction [(10) form] forms the [means] support for attaching the integrated apparatus assembly to a bed.

6. (Amended) An electric machine construction according to [any of the preceding claims] claim 1, [characterized in that it is] further comprising [provided with] a blower [means] so as to intensify the cooling medium flow.

7. (Amended) An electric machine construction according to [any of the preceding claims] claim 1, [characterized in that it] further [comprises] comprising a heat exchanger [means (24)] provided within a space [(23)] between the outer surface of the shell [(8)] and the outer housing for cooling of the cooling medium flow, the construction being arranged to enable a closed circulation [(25, 14, 9, 12, 23)] of the cooling medium flow.

8. (Amended) A method for an electric machine construction, comprising a stator space [(9)] defined by a shell [(8)] and end portions [(6)] at the either ends of the shell [(8)], wherein a stator [means] and a rotor [means] of the electric machine are disposed within said stator space, [characterized in that] wherein cooling medium is drawn into the stator space [(9)] through at least one cooling medium inlet opening [(14, 34)] in said shell [(8)] intermediate the ends of the rotor [means (20)] by [means of suction caused by] suction means [(13)] for providing [the] a suction, said suction means [(13)] being provided at [the] a vicinity of both end portions [(6)], and the cooling medium is removed at the vicinity of

both ends portions [(6)] of the stator space [(9)].

9. (Amended) A method according to claim 8, [characterized in that the] wherein suction aided conduction of the cooling medium into the stator space [(9)], circulation within the stator space and removal [(12)] from the stator space occurs symmetrically relative to the electric machine construction [(10)].

10. (Amended) A method according to claim 8 [or 9], wherein [characterized in that it further includes mounting of] an apparatus [(30)] to be driven by the electric machine [(10)] is mounted directly to the end portion [(6)] of the electric machine construction, and [utilizing the attachment means (5)] wherein a support is integrated in the end portion [(6)] of the machine construction [(10)] in attaching the integrated apparatus assembly to a bed.

11. (Amended) A method according to [any of claims 8 to 10,] claim 8, further comprising a step of [characterized in that it further includes] intensifying the cooling medium flow by a blower [means].

12. (Amended) A method according to [any of claims] claim 8 [to 11], [characterized in that it] further [includes] comprising cooling [of] the cooling medium flow by a heat exchanger [means (24)] provided within a space [(23)] between the outer surface of the shell [(8)] and the outer housing so as to enable a closed circulation [(25, 14, 9, 12, 23)] of the cooling medium flow.

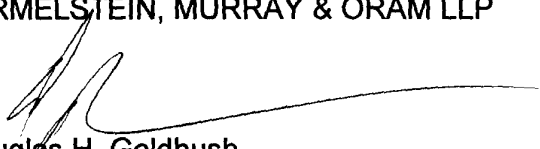
REMARKS

The above amendment to the claims have been made to place the application in better condition for examination. No new matter has been added. Claims 1-12 are respectfully submitted for consideration.

In the event that any fees are due in connection with this paper, please charge our Deposit Account No. 14-1060.

Respectfully submitted,

NIKAIDO, MARMELSTEIN, MURRAY & ORAM LLP



Douglas H. Goldhush
Attorney for Applicant
Reg. No. 33,125

Atty. Docket No.: P8306-9004

Metropolitan Square
655 15th Street, N. W.
Suite 330 - G Street Lobby
Washington, D. C. 20005-5701
Tel (202) 638-5000
Fax (202) 638-4810

DHG:scc

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510 Recd PCT/TO 07 APR 1999

An electric machine construction and a method for an electric machine

The present invention relates to a construction according to the preamble of claim 1 to be used, for example, in connection with electric motors. The invention relates further to a method according to the preamble of claim 8 to be used in connection with, for example, electric motors.

It is prior known to arrange cooling of eg. an electric machine, especially the input and/or output (blow in/out) of the cooling air, from one end thereof, usually by means of a fan arranged to said one end. The air is blown by means of the fan or blower such that the air is forced to enter into the machine housing. The air may even be pressurized over the atmospheric pressure so as to ensure the flow thereof into the machine housing and subsequently out of the machine housing.

A motor-actuator combination, such as a motor + a pump or a compressor, is usually arranged such that the motor and the actuator are mounted as separate units either to a same bed or even to separate beds. In the known structure the power output of the motor is usually arranged to the other end thereof only, ie. it has not been possible to provide more than one single actuator device. In case of two output shafts, the additional second shaft is usually only adapted to extend through the per se conventional other end including the fan.

The presented solutions, however, do have several disadvantages. For instance, the blower based supplying of the air has not in all instances been enough to provide a sufficient cooling of the entire construction. The conventional cooling arrangements, when combined with the solutions enabling power output from both ends of the electric motor, have presented some overheating problems, as the original design is not intended for any kind of shafts extending through the blower means at the other end. In addition, the provision of a closed or open symmetrical cooling, and thus a uniform cooling of the machine, has proven to be difficult. The cooling by means of a blower has itself increased the temperature of the cooling medium, ie. the air, since the temperature of the air increases as the pressure increases. No satisfying solution for a closed circulation of the medium has been suggested. Furthermore, the mutual adjustment of the motor and the actuator at the assembly site has proven to be a labour consuming and difficult operation. In addition, small relative movements may occur between the actuator and the motor disposed on separate beds during the use thereof. The mutual positioning thereof is not always assemb-

led correctly, or it changes during the use. The incorrect mutual positioning and/or the unwanted relative movements usually lead in general into leaks and/or additional wear of other parts, such as bearings.

The present invention seeks to overcome the disadvantages of the prior art and to provide a new type of construction and a method for the electric machines. The invention seeks to provide a cooling arrangement and a method which itself does not give any rise to the temperature of the machine construction. The invention seeks also to provide an electric machine construction and a method which enables an uniform cooling arranged in a symmetrical manner. In addition, the invention seeks for a provision of an electric machine construction which provides a possibility for an improved attachment solution of an actuator to the both ends of the machine. The invention seeks also for a provision of a solution which enables an integrated motor-actuator assembly. The invention seeks further to obtain a machine construction having such end portions thereof which form also the means for attachment of the machine. A still further object is a solution which enables a closed circulation of the cooling medium.

The invention is based on the basic idea that by providing a machine construction and a method in which the cooling medium or fluid is arranged to be conducted inside a stator space in a vacuum or suction aided manner through at least one opening in the shell thereof, a design and a method is provided which implements the objects set for the invention. The machine construction is preferably such that the circulation of the cooling medium or fluid occurs symmetrically, such as by providing the supply of the medium through the shell of the stator space and the removal thereof symmetrically at the both ends of the construction or closely adjacent to the ends. The construction according to a preferred form of the invention allows an arrangement in which the end portions of the machine receive the attaching members of the actuator and also, if desired, an arrangement in which the end portions function as means for attaching the entire assembly to the bed.

More precisely, the construction according to the present invention is mainly characterized by what is disclosed in appended claims 1...7 and especially by claim 1. The method according to the present invention is mainly characterized by what is disclosed in appended claims 8...12 and especially by claim 8.

Several advantages are obtained by means of the present invention. The cooling of the machine which is constructed according to the principles of the present invention occurs

evenly and the cooling is enhanced when compared to the prior art solutions. Mounting of a motor and actuator assembly is eased and quickened essentially, while the amount of required separate mounting stands is decreased and said assembly becomes more simple from the general construction thereof. The assembly according to the invention is economical to manufacture, for instance due to the smaller amount of various parts. In addition, the reliability of the motor and actuator assembly is improved, for instance due to the improved accuracy in mounting and lowered risk for relative movements between the various components of the assembly.

In the following the present invention and the other objects and advantages thereof will be described in an exemplifying manner with reference to the annexed drawings, in which similar reference characters throughout the various figures refer to similar features. It should be understood that the following exemplifying description is not meant to restrict the invention to the specific forms presented in this connection but rather the present invention is meant to cover all modifications, similarities and alternatives which are included in the spirit and scope of the present invention, as defined by the appended claims.

Figures 1a and 1b disclose a motor according to the present invention from two directions.

Figure 2 discloses a sectional view of the motor structure.

Figures 3a, 3b and 3c disclose one assembly from three different directions.

Figures 4a, 4b and 4c disclose, partially in section, some additional embodiments.

In some of the figures a part of such contours, which are not visible in the reality but are disposed beyond the surfaces between them and the viewer, are presented by dashed lines. In addition, in some figures the dashed lines are presented to indicate the center lines of the apparatus.

Figures 1a and 1b disclose a motor construction 10 according to the invention from the side and respectively from the end thereof such that a possible actuator attached therein has been omitted. The motor construction 10 comprises an essentially cylindrical body portion 8 or a body shell. The rotor and stator members of the motor are positioned within said shell in a manner per se known by the skilled person (see figure 2).

An end plate 6 is attached to both ends of the body portion 8. The end plate 6 extends at least in one side of the motor over the width of the body portion 8 such that it forms a

mounting support 5, as is shown by figs. 1a and 1b or 3a and 3b. It can be noted that the housing structure of the motor 10 is formed from only three per se simple pieces, from which the end plates 6 are identical with each other.

Power output shafts 4 are provided at both ends of the motor. This is enabled eg. by the constructional arrangement disclosed by figure 2. According to that the cooling air or similar fluid is drawn by means of a suction through the shell 8 of the motor via openings 14 in a manner designated by the arrows into the stator space 9, wherein the suction is generated by the rotation of the rotor 20. The air is thereafter circulated symmetrically inside the stator space, as is designated by the additional arrows. To generate the suction, the rotor shaft 20 may be provided with fans 13. In figure 2 the air which flows symmetrically within the motor, as is designated by the arrows, leaves the stator space 9 through removal openings 12 provided in connection with the ends 6. Thus the solution provides a symmetrical cooling for the entire machine. The arrangement is such that the air is not blown into machine, and the air is thus not pressurized as it enters the machine, but that the air is instead drawn into the machine by means of the suction generated by the rotation of the rotor and the fans 13. As a matter of fact, some throttling occurs in the suction openings 14, said throttling cooling the circulating air. This is an opposite effect to the solutions based on blowing, in which the air tends to heat as it is pressurized, and in which the amount of heating may be essentially high. By means of an appropriate shaping of the grooves of the rotor 20 it is even possible to further effectuate the flow of the cooling air.

It is to be noted that the number and positioning of the suction openings 4 and the removal openings 12 is not intended to be limited to those shown by figure 2. It is for instance possible that the removal openings are disposed closer to the center of the structure and the suction openings are disposed closer to the ends of the structure, or are arranged in connection with the ends. What is essential here is that the cooling air is drawn into the machine by means of suction.

Figures 3a to 3c disclose one assembly according to the present invention. An actuator is mounted to both ends of the motor 10. In the figures the actuator is shown to be a compressor 30, but it can be any device requiring rotating input power, such as a pump, a gear and so on.

The compressor 30 is attached directly to the end plate 6 of the motor 10 by means of attachment members 32, said end plate operating also as mounting support 5 of the motor

and actuator assembly. The attachment members 32 are shown to be formed of sleeves or pipe spacers through which conventional screws are extending, said screws being tightened by nuts. Other type of mounting can also be used, such as mounting frame or legs etc. means adapted for attaching separate members to each other and per se known by the skilled person. The essential in here is that the actuator is attached directly to the end plate 6, which also functions at the same time as a mounting member 5 of the integrated assembly.

Figures 3b and 3c disclose also a shell conduit 34 provided on the motor shell 8, through which the cooling air is arranged to be conducted into the motor. The cooling air conduit may also include a suitable fan so as to enhance the flow of air. The air is vented through the ends 6 of the motor, but in this case in axial direction. An oil tank 36 of a circulation lubrication system has also been disclosed to be positioned between the legs 5. However, this is only an example of the utilization of this space, and it is possible to place any desired auxiliary device into this location.

Figure 4a discloses as a sectioned view a part of a motor, and more precisely, a portion of the other end thereof, showing one solution for implementing the cooling circulation. The air which is vented axially through the end is conducted to a heat exchanger means 24 within a space 23, and subsequently out from the space 23, as is indicated by the arrows. The skilled person is familiar with the heat exchanger means, such as the plate heat exchanger 24 of figure 4a or tube heat exchanger of figure 4c, and they are thus not explained in more detail herein than by mentioning that the operation thereof may be based eg. on liquid or gas cooling.

In figures 4b and 4c a closed circulation has been provided such that the shell 8 of the stator space forms an intermediate body disposed inside an outer housing 22 of the motor. In figure 4b the cooling medium circulates in a manner indicated by arrows from the space between the outer housing 22 and the shell 8 to the stator space 9, wherefrom it is further transferred axially to the cooling space 23 by means of the fan means 13. The heat exchanger means, such as the plate heat exchanger of figure 4a or the tube heat exchanger of figure 4c, are positioned in said cooling space. From the cooling space 23 the cooled cooling medium is transferred back to space 25, and it may thus initiate a new cooling circle.

Figure 4c discloses almost a similar construction, but using a radial fan 13, whereby the removal of the air from the stator space 9 closely adjacent to the end 6 occurs radially

through an opening 12 to the chamber or space 23 between the shell 8 and the outer housing. Said space 23 includes a tube heat exchanger 24.

The medium conduits between the outer surface of the shell 8 and the housing 22 can be provided in various manners, such as by grooves provided on the outer surface of the shell, or by a clearance between the shell and the housing 22, by suitable bores etc. manner readily apparent to the skilled person.

Thus the invention provides an apparatus and a method by means of which a significant improvement is achieved to the prior art. For instance, by means of the invention it is possible to improve the cooling and/or ventilation characteristics of the machine. In addition, a power output from both ends of the machine is enabled without a risk for overheating problems. The number of different parts is also minimized, and the general construction of the assembly is simplified.

It is to be noted that the above examples are not intended to limit the scope of the invention, as defined by the appended claims. It is, of course, apparent to the skilled person that it is possible to use other fluids or mediums in the cooling as air, such as eg. cooling medium based on liquid or gas.

Claims

1. An electric machine construction, comprising
a stator space (9) defined by a shell (8) and end portions (6) at both ends of the shell (8),
stator means and rotor means (20) having a first end and a second end disposed within said stator space (9),
c h a r a c t e r i z e d by comprising
at least one cooling medium inlet opening (14,34) in the shell (8) and positioned intermediate the ends of the rotor means (20),
means (13) at the vicinity of both end portions (6) of the stator space (9) for providing suction for drawing cooling medium into said stator space (9),
wherein the arrangement is such that the cooling medium is drawn by the suction into the stator space (9) through said at least one inlet opening (14,34) and that the cooling medium is removed at the vicinity of both end portions (6) of the stator space (9).
2. An electric machine construction according to claim 1, c h a r a c t e r i z e d in that the conduction of the cooling medium into the stator space (9), circulation within the stator space and removal (12) from the stator space is arranged such that it occurs symmetrically relative to the electric machine construction (10).
3. An electric machine construction according to claim 1 or 2, c h a r a c t e r i z e d in that said end portions (6) are arranged further to form attachment means (5) of the electric machine construction for the attachment thereof to a mounting bed.
4. An electric machine construction according to any of the preceding claims, c h a r a c t e r i z e d in that the both ends of the electric machine construction (10) are provided with power output shafts (4).

5. An electric machine construction according to any of the preceding claims, characterized in that the apparatus (30) to be driven by the electric machine (10) is attached (32) directly to the end portion (6) of the electric machine construction, whereby the attachment means (5) integrated in the end portion (6) of the machine construction (10) form the means for attaching the integrated apparatus assembly to a bed.

6. An electric machine construction according to any of the preceding claims, characterized in that it is further provided with blower means so as to intensify the cooling medium flow.

7. An electric machine construction according to any of the preceding claims, characterized in that it further comprises heat exchanger means (24) provided within a space (23) between the outer surface of the shell (8) and the outer housing for cooling of the cooling medium flow, the construction being arranged to enable a closed circulation (25,14,9,12,23) of the cooling medium flow.

8. A method for an electric machine construction comprising a stator space (9) defined by a shell (8) and end portions (6) at the either ends of the shell (8), wherein stator means and rotor means of the electric machine are disposed within said stator space, characterized in that cooling medium is drawn into the stator space (9) through at least one cooling medium inlet opening (14,34) in said shell (8) intermediate the ends of the rotor means (20) by means of suction caused by means (13) for providing the suction, said means (13) being provided at the vicinity of both end portions (6), and the cooling medium is removed at the vicinity of both ends portions (6) of the stator space (9).

9. A method according to claim 8, characterized in that the suction aided conduction of the cooling medium

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into the stator space (9), circulation within the stator space and removal (12) from the stator space occurs symmetrically relative to the electric machine construction (10).

10. A method according to claim 8 or 9,
c h a r a c t e r i z e d in that it further includes mounting of an apparatus (30) to be driven by the electric machine (10) directly to the end portion (6) of the electric machine construction, and utilizing the attachment means (5) integrated in the end portion (6) of the machine construction (10) in attaching the integrated apparatus assembly to a bed.

11. A method according to any of claims 8 to 10,
c h a r a c t e r i z e d in that it further includes intensifying the cooling medium flow by blower means.

12. A method according to any of claims 8 to 11,
c h a r a c t e r i z e d in that it further includes cooling of the cooling medium flow by heat exchanger means (24) provided within a space (23) between the outer surface of the shell (8) and the outer housing so as to enable a closed circulation (25,14,9,12,23) of the cooling medium flow.

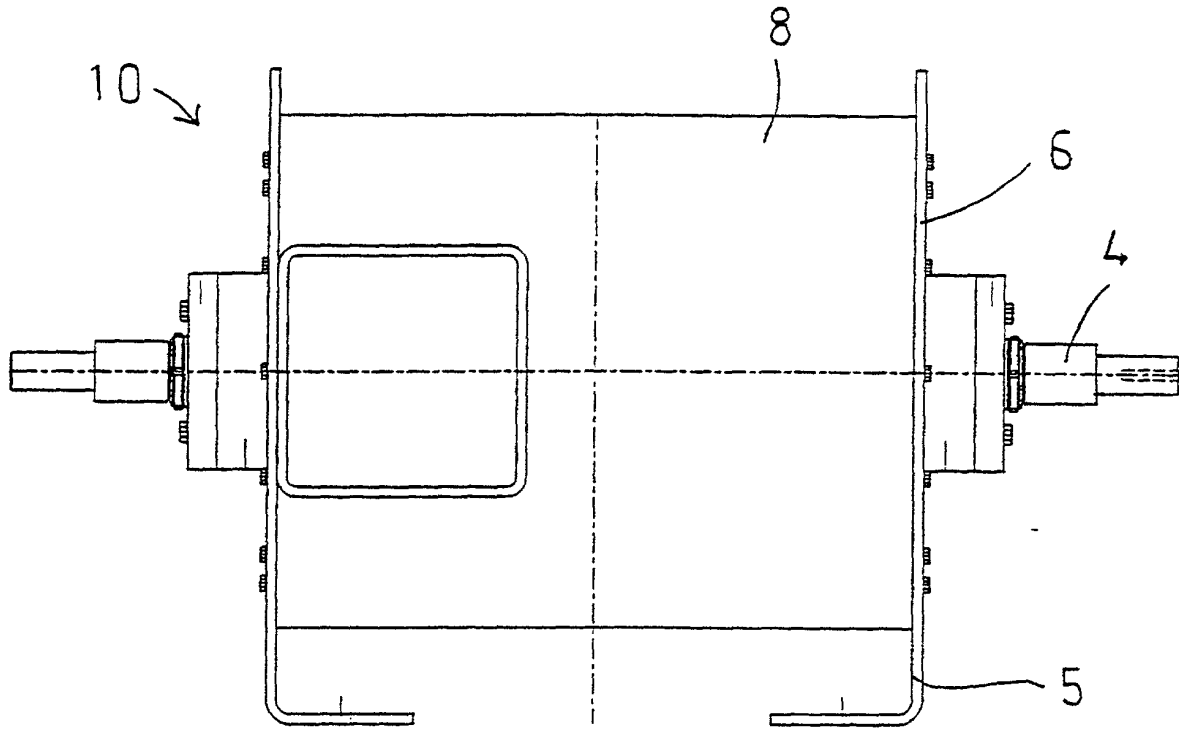


Fig 1a

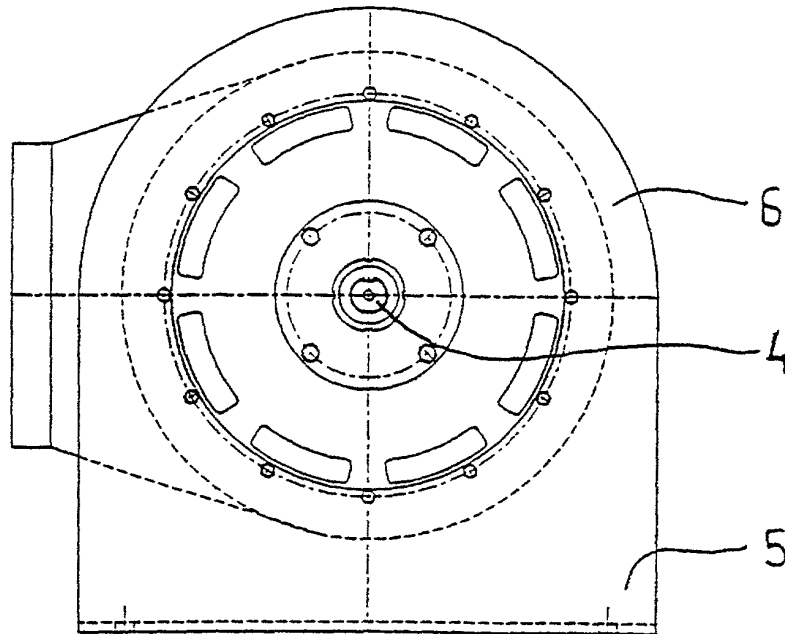


Fig 1b

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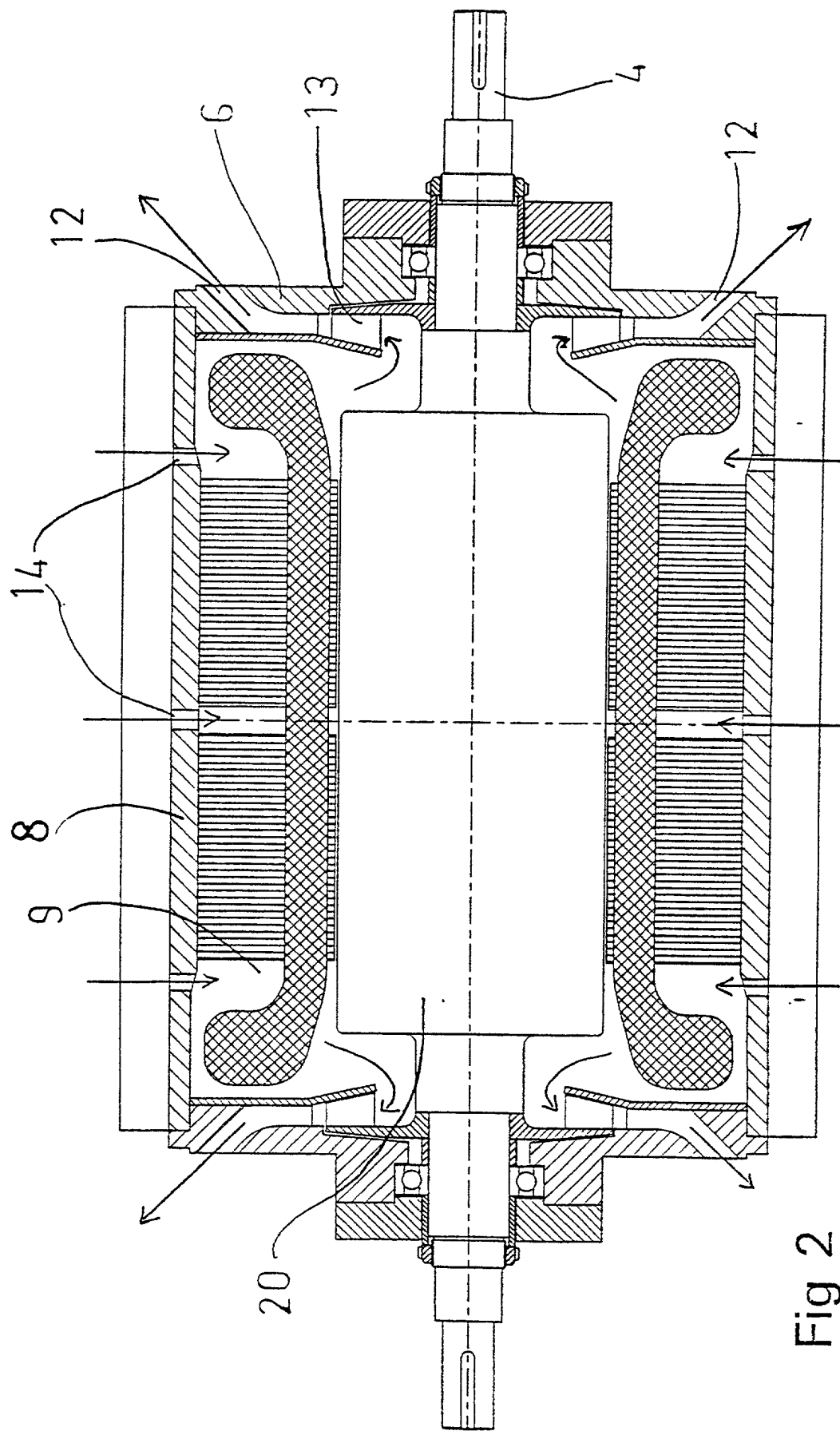


Fig 2

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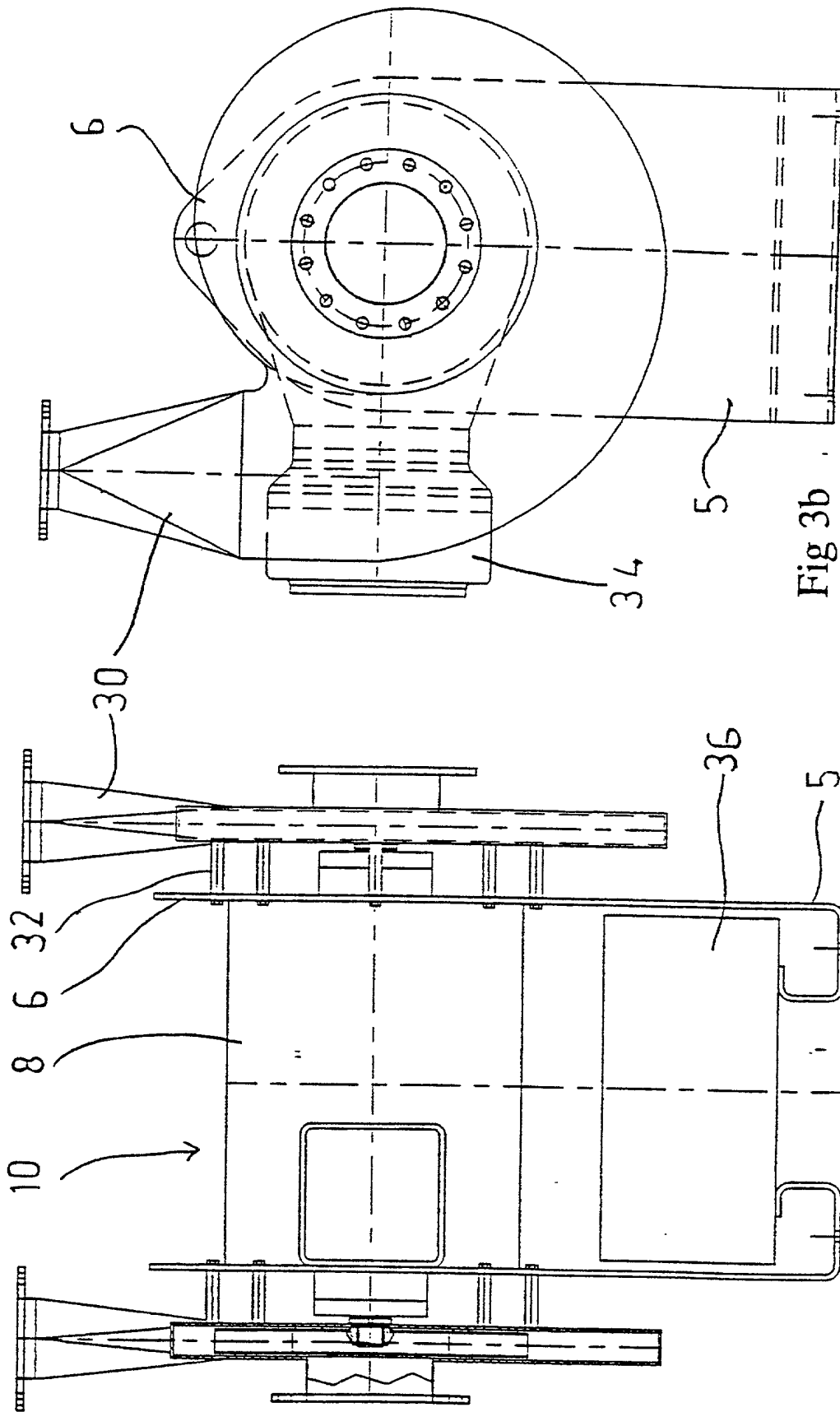
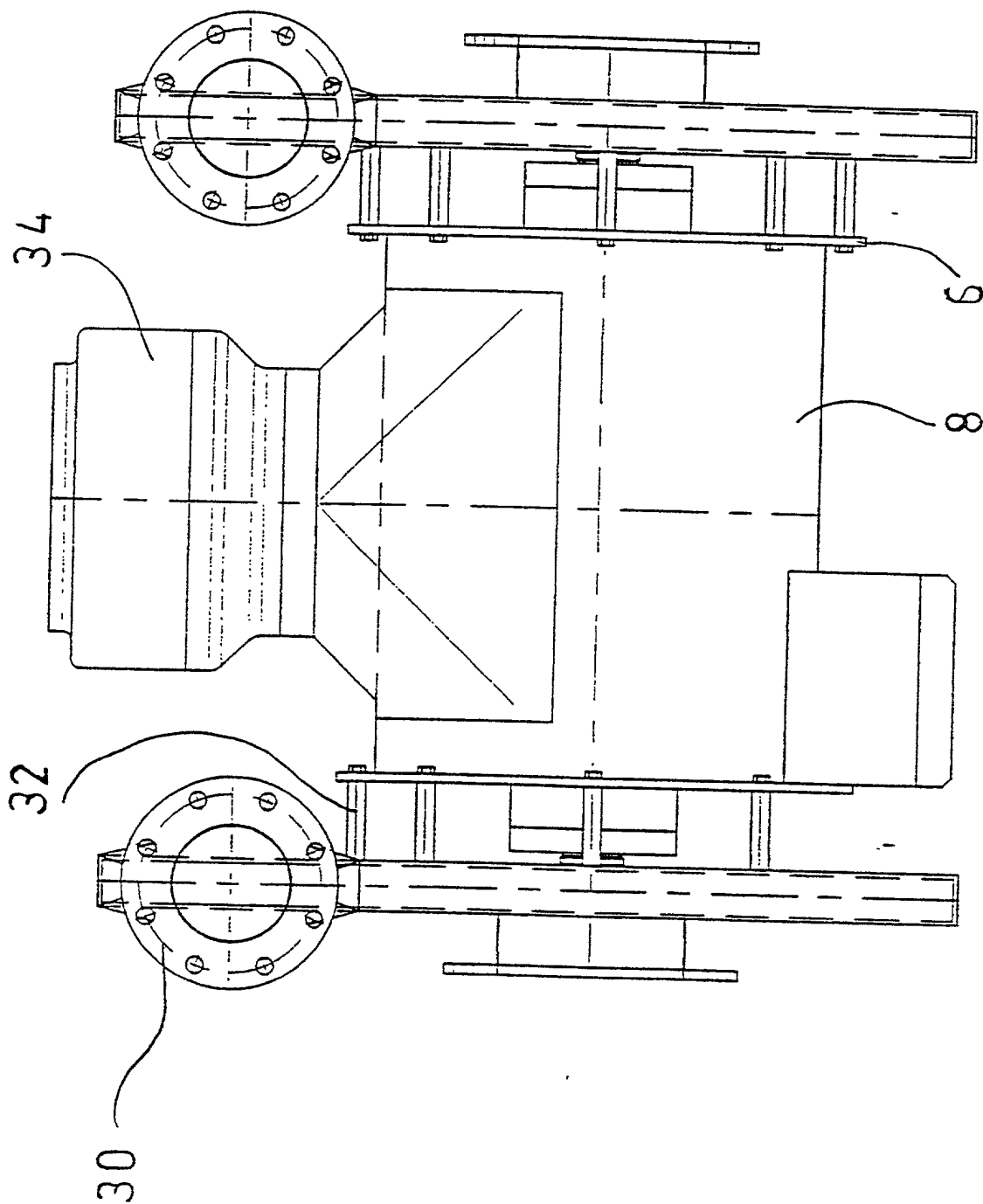


Fig 3b

Fig 3a



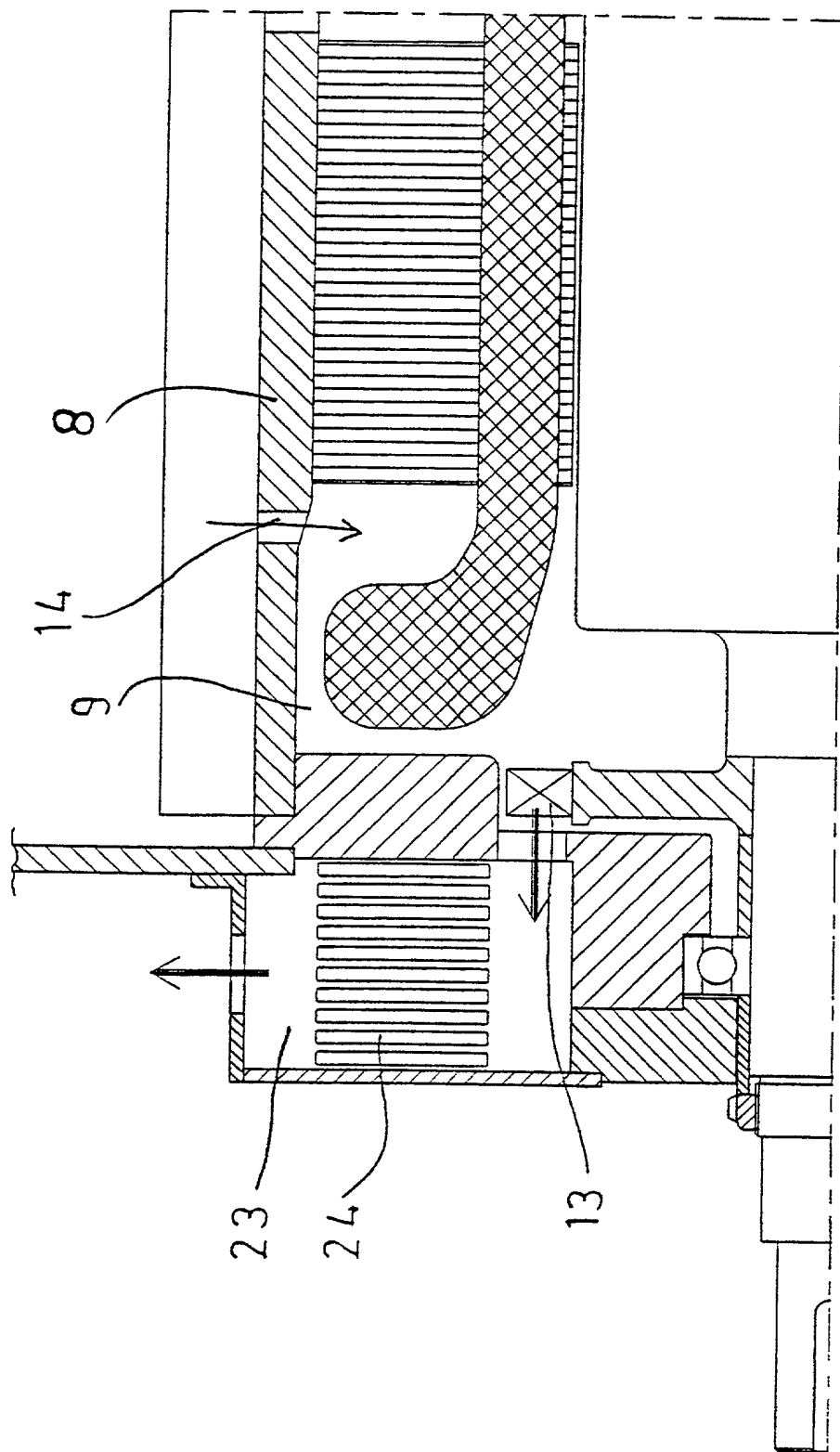
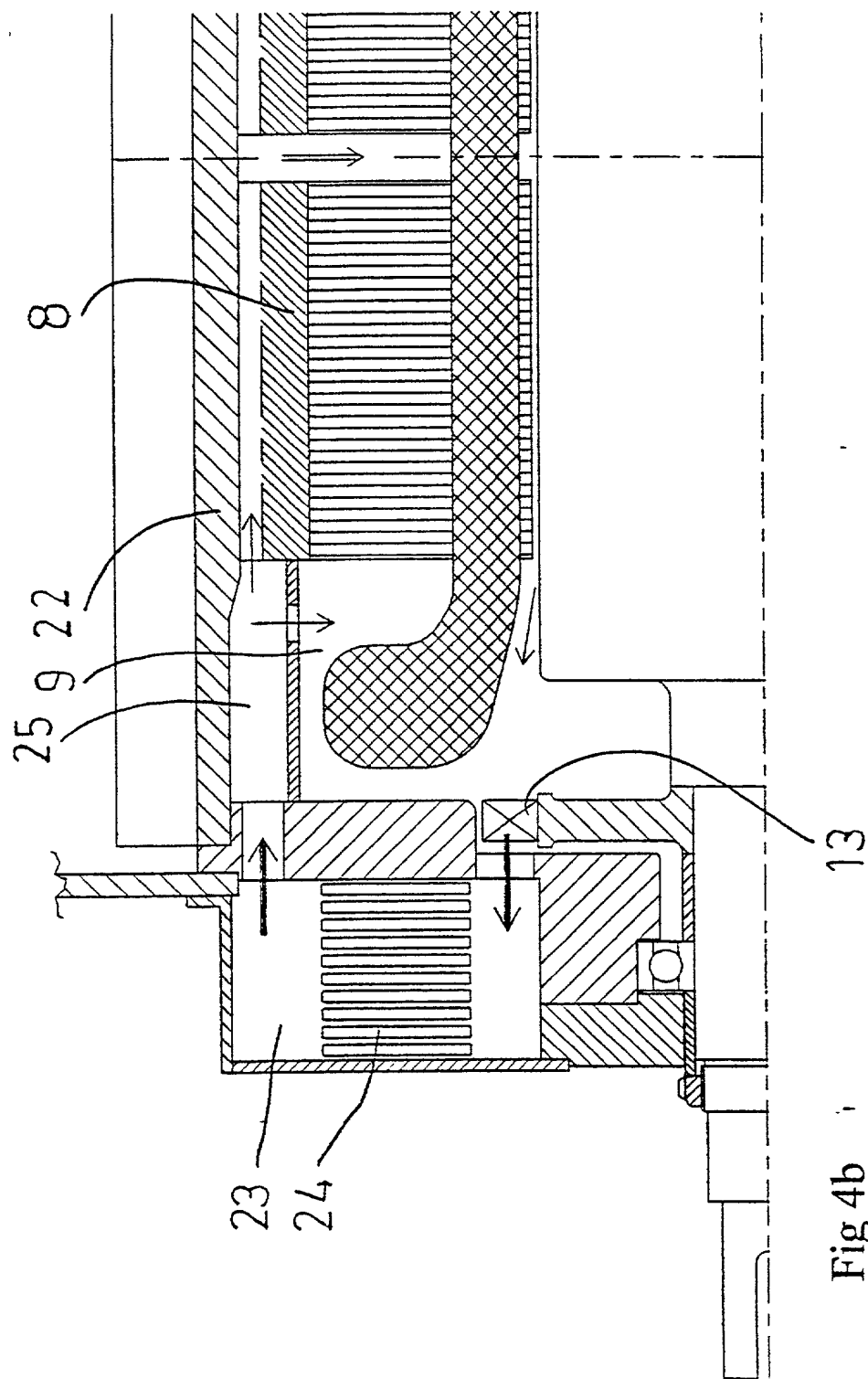


Fig 4a



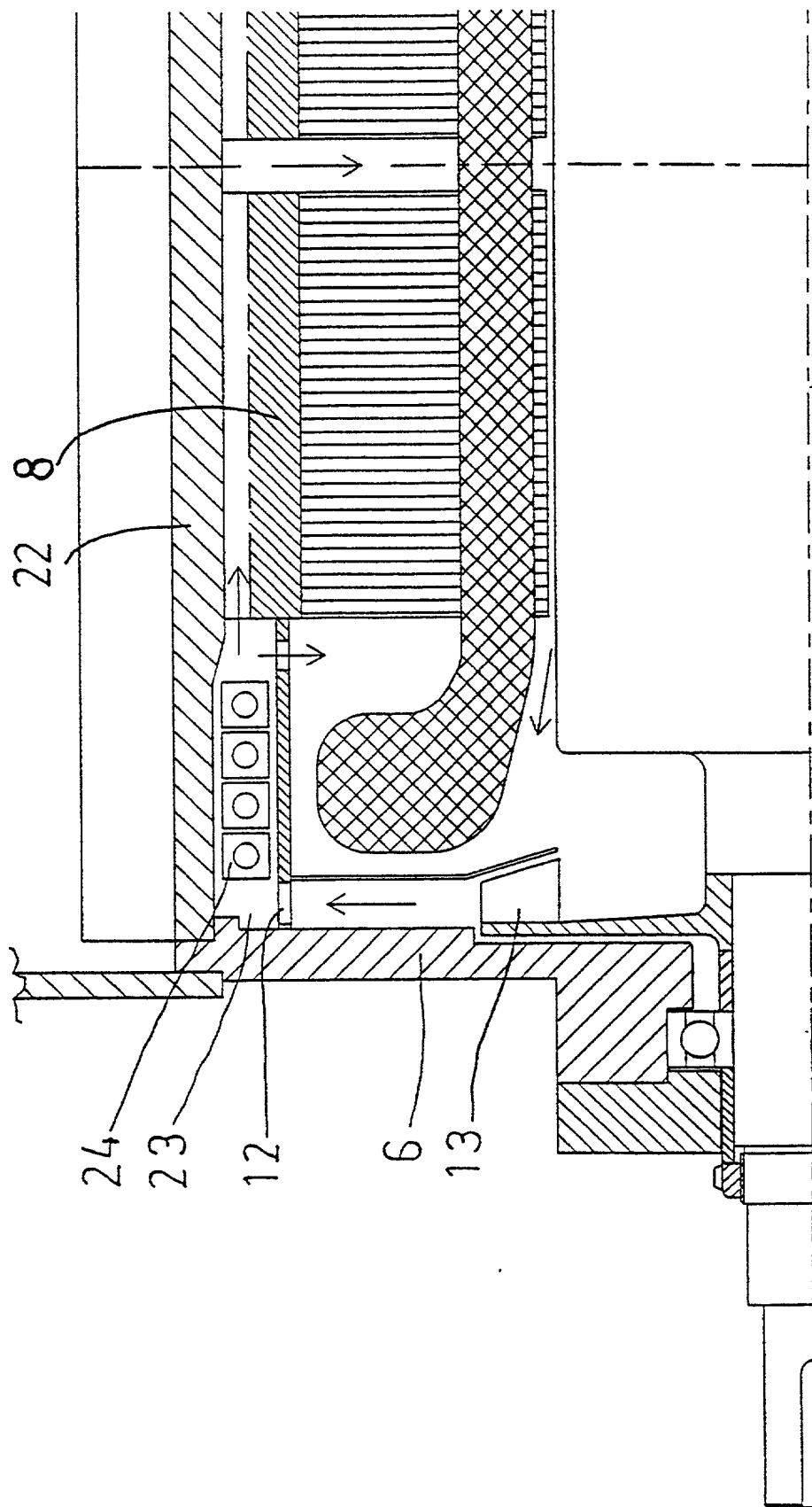


Fig 4c

SMALL ENTITY DECLARATION

APPLICANT OR PATENTEE ROTATEK FINLAND OY

SERIAL NO. _____ ☐ PATENT NO. _____ ATTORNEY'S DOCKET NO. _____

☐ 1. FILED OR ISSUED _____

☒ 2. SUBMITTED HEREWITH _____
FOR AN ELECTRIC MACHINE CONSTRUCTION AND A METHOD FOR AN ELECTRIC
MACHINE (Insert Title)

I (we) hereby declare that I (we) am (are) entitled to the benefit of small entity status with respect to the above-identified application or patent for purposes of paying reduced fees under 35 U.S.C. §§41(a) and (b) to the U.S. Patent and Trademark Office.

☐ A. **INDEPENDENT INVENTOR**

I (we) qualify as (an) independent inventor(s) as defined in 37 C.F.R. §1.9(c).

☐ B. **INDIVIDUAL NON-INVENTOR**

I (we) would qualify as (an) independent inventor(s) as defined in 37 C.F.R. §1.9(c) if I (we) had made the invention.

☒ C. **SMALL BUSINESS CONCERN**

I am ☐ THE OWNER ☐ AN OFFICIAL of the small business concern identified below and am empowered to act on behalf of the concern. The concern qualifies under 37 C.F.R. §1.9(d) and 13 C.F.R. §121.3-18. Rights under contract or law have been conveyed to and remain with the concern and are exclusive unless a checkmark is placed here ☐. All other rights belong to small entities as defined in 37 C.F.R. §1.9.

☐ D. **NON-PROFIT ORGANIZATION**

I am an official empowered to act on behalf of the non-profit organization identified below. The organization qualifies under 37 C.F.R. §1.9(e), subsection: ☐ (1) ☐ (2) ☐ (3) ☐ (4). Rights under contract or law have been conveyed to and remain with the organization and are exclusive unless a checkmark is placed here ☐. All other rights belong to small entities as defined in 37 C.F.R. §1.9.

I (we) acknowledge the duty to file, in this application or patent, notification of any change in status resulting in loss of entitlement to small entity status prior to paying, or at the time of paying, the earliest of the issue fee or any maintenance fee due after the date on which status as a small entity is no longer appropriate [37 C.F.R. §1.28(b)].

I (we) declare under penalty of perjury under the laws of the United States of America that the foregoing is true and correct.

A. INDEPENDENT INVENTORS(S) B. INDIVIDUAL NON-INVENTOR(S)

| | | |
|---------------|--------------------|---------------|
| _____ Name | _____ Signature | _____ Date |
| _____ Name | _____ Signature | _____ Date |
| _____ Name | _____ Signature | _____ Date |

C. BUSINESS CONCERN D. NON-PROFIT ORGANIZATION

| | |
|--|--|
| <u>Rotatek Finland Oy</u> Name of Concern or Organization | <u>Laserkatu 6, FIN-53850 Lappeenranta, Finland</u> Address |
| By <u>Jarmo Alamäki</u> Name of Person Signing | <u><i>Jarmo Alamäki</i></u> Signature |
| <u>Managing Director</u> Title | <u>16.3.1999</u> Date |

Declaration For U.S. Patent Application

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

(Insert Title) AN ELECTRIC MACHINE CONSTRUCTION AND A METHOD FOR AN ELECTRIC MACHINE

the specification of which is attached hereto unless the following box is checked:

☒ was filed on October 1997 as PCT International Application
 Number PCT/FI97/00605 and was amended on _____
 and/or was filed on _____ as United States Application
 Number _____ and was amended on _____

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claim(s), as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in 37 C.F.R. §1.56.

I hereby claim foreign priority benefits under 35 U.S.C. §119(a)-(d) or §365(b) of any foreign application(s) for patent or inventor's certificate, or §365(a) of any PCT International application which designated at least one country other than the United States, listed below and have also identified below any foreign application for patent or inventor's certificate or PCT International Application having a filing date before that of the application(s) for which priority is claimed:

| | | | | |
|--|----------------------------|------------------------|---|---|
| (List prior foreign applications. See note A on back of this page) | <u>U960512</u> (Number) | <u>FI</u> (Country) | <u>08/10/96</u> (Day/Month/Year Filed) | Priority Claimed <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No |
| | _____ (Number) | _____ (Country) | _____ (Day/Month/Year Filed) | <input type="checkbox"/> Yes <input type="checkbox"/> No |
| | _____ (Number) | _____ (Country) | _____ (Day/Month/Year Filed) | <input type="checkbox"/> Yes <input type="checkbox"/> No |

I hereby claim the benefit under 35 U.S.C. §119(e) of any United States provisional application(s) listed below.

| | |
|-------------------------------|------------------------|
| _____ (Application Number) | _____ (Filing Date) |
| _____ (Application Number) | _____ (Filing Date) |

(See Note B on back of this page)

☐ See attached list for additional prior foreign or provisional applications.

I hereby claim the benefit under 35 U.S.C. §120 of any United States application(s) or §365(c) of any PCT International application(s) designating the United States of America listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior application(s) (U.S. or PCT) in the manner provided by the first paragraph of 35, U.S.C. §112, I acknowledge the duty to disclose information which is material to patentability as defined in 37 C.F.R. §1.56 which became available between the filing date of the prior application and the national or PCT International filing date of this application.

| | | | |
|---|-----------------------------------|------------------------|--|
| (List prior U.S. Applications or PCT International applications designating the U.S.) | _____ (Application Serial No.) | _____ (Filing Date) | _____ (Status) (patented, pending, abandoned) |
| | _____ (Application Serial No.) | _____ (Filing Date) | _____ (Status) (patented, pending, abandoned) |

And I hereby appoint as principal attorneys: David T. Nikaido, Reg. No. 22,663; Charles M. Marmelstein, Reg. No. 25,895; George E. Oram, Jr., Reg. No. 27,931; Robert B. Murray, Reg. No. 22,980; Martin S. Postman, Reg. No. 18,570; E. Marcie Emas, Reg. No. 32,131; Douglas H. Goldhush, Reg. No. 33,125; Kevin C. Brown, Reg. No. 32,402; Monica Chin Kitts, Reg. No. 36,105; Richard J. Berman, Reg. No. 39,107; King L. Wong, Reg. No. 37,500; Karen K. Costantino, Reg. No. 35,107; and James A. Poulos, III, Reg. No. 31,714.

Please direct all communications to the following address: NIKAIDO, MARMELSTEIN, MURRAY & ORAM LLP
Metropolitan Square
655 Fifteenth Street, N.W., Suite 330 - G Street Lobby
Washington, D.C. 20005-5701
(202) 638-5000 Fax: (202) 638-4810

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further, that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

(See Note C on back of this page)

Full name of sole or first inventor PYRHÖNEN, Juha
 Inventor's signature [Signature] Date 16.3.1997
 Residence Kotkankatu 32, FIN-53850 Lappeenranta, Finland FI
 Citizenship Finnish
 Post Office Address Kotkankatu 32, FIN-53850 Lappeenranta, Finland